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Indian Standard

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भाग 22 ए. सी. चार्ज विन्यास

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Electric Vehicle Conductive Charging Systems

Part 22 A.C. Charging Configurations

Section 1 A.C. charge point for light electric vehicle

ICS 43.120

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FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Electro technology in Mobility Sectional Committee had been approved by the Electrotechnical Division Council.

This standard describes the specific requirements for AC outlet with “one box, one connector” concept having energy measurement and communication provisions. Light Electric Vehicle AC Charge Point is proposed to cater the charging needs of mainly electric powered two or three wheelers and Quadricycles (hereafter LEVs). It has been envisaged that the portable charge point can be easily installed at small shops, residential parking places, parking areas of commercial complexes, etc.

Considerable assistance has been obtained from IS 17017 (Part 1) : 2018 while preparing this standard. This standard corresponds to the requirement of IS 17017 (Part 1) : 2018 in the requirements it contains, but certain modifications have been done in relation to the cross-referred standard, including content, and connectors. The connectors may be designed in accordance with the Socket-Outlets as per IS/IEC 60309-1 : 2002. The configuration is designed based on the feedback from actual prototyping and pilot field experience.

The composition of the committee responsible for formulation of this standard is given at Annex E.

For the purpose of deciding whether a particular requirement of this temporary standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding of numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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Indian Standard

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM

PART 22 A.C. CHARGING CONFIGURATIONS

Section 1 A.C. Charge point for light electric vehicles

1 SCOPE

This standard is applicable to Light Electric Vehicle AC Charge Point (LEV AC Charge Point), which is a basic conductive AC charging option for charging light electric road vehicles with rated supply voltage 240 V a.c. and current up to 16A a.c.

The standard covers requirements of LEV AC Charge Point with respect to functionality, environmental aspects, energy measurement, mechanical and electrical safety considerations.

2 REFERENCES

The standards listed below contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

IS No./ Other Publication	*Title*
IS 302 (Part 1) : 2008	Safety of household and similar appliances: Part 1 General requirements
IS 732 : 2019	Code of practice for electrical wiring installations
IS 1293 : 2019	Plugs and socket — Outlets of rated Voltage up to and including 250 Volts and rated current up to and including 16 amperes — Specification
IS 9000 (Part 2/ Sec 1 to 4) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 2 Cold test
IS 9000 (Part 3/ Sec 1 to 5) : 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test
IS 9000 (Part 4) : 2008	Basic environmental testing procedures for electronic and electrical items: Part 4 Damp heat (steady state)
IS 9000 (Part 5/ Sec 1 and 2) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 5 Damp heat (cyclic)test
IS 12346 : 1999	Testing equipment for AC electrical energy meters
IS 12360 : 1988	Voltage bands for electrical installations including preferred voltages and frequency
IS 12640 (Part 1) : 2016	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs): Part 1 General rules
IS 12640 (Part 2) : 2016	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs): Part 2 General rules
IS 13703 (All Parts)	Low-voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC
IS 13799 : 2020	AC static watthour meters, class 1 and class 2 specification

IS No./ Other Publication	*Title*
IS 15382 (Part 1) : 2014	Insulation coordination for equipment within low-voltage Systems: Part 1 Principles, requirements, and tests
IS 16444 : 2015	A.C. static direct connected watthour smart meter class 1 and 2 –specification
IS 16444 (Part 2) : 2017	A.C. static transformer operated watthour and var-hour smart meters, class 0.2 S, 0.5 S and 1.0 S — Part 2: specification transformer operated smart meters
IS 17017 (Part 1) : 2018	Electric Vehicle Conductive Charging System Part 1 General Requirements
IS 17017 (Part 21/ Sec 2) : 2019	Electric Vehicle Conductive Charging System: Part 21 ElectromagneticCompatibility (EMC) Requirements: Section 2 Off-board chargers
IS 17050 : 2018	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
IS 17064 (Part 1) : 2018	Electromechanical elementary relays: Part 1 General and safety requirements
IS/IEC 60309 (Part 1) : 2002	Plugs, socket-outlets and couplers for industrial purposes: Part 1 General requirements
IS/IEC 60309 (Part 2) : 2002	Plugs, socket-outlets and couplers for industrial purposes: Part 2 Dimensional interchangeability requirements for pin and contact – Tube accessories
IS/IEC 60529 : 2001	Degrees of protection provided by enclosures (IP Code)
IS/IEC 60898-1 : 2002	Electrical accessories — Circuit-breakers for overcurrent protection for household and similar installations: Part1Circuit-breakers for a.c. operation
IS/IEC 60898-2 : 2003	Electrical accessories — Circuit-breakers for overcurrent protection for household and similar installations: Part 2 Circuit-breakers for a.c. and d.c. operation
IS/IEC 60947 (Part 2) : 2016	Low-voltage switchgear and control gear: Part 2 Circuit-breakers
IS/IEC 60947 (Part 3) : 2012	Low-voltage switchgear and control gear: Part 3 Switches, disconnectors, switch-disconnectors and fuse-combination units
IS/IEC 60947 (Part 5/Sec 5) : 1997+AMD1 : 2005+AMD2 : 2016	Low-voltage switchgear and control gear - Part 5-5: Control circuit devices and switching elements — Electrical emergency stop device with mechanical latching function
IS/IEC 60990 : 2016	Methods of measurement of touch current and protective conductor current
IS/IEC 61508 (All Parts)	Functional safety of electrical/electronic/ programmable electronic safety-related systems
IS/IEC 61558 (Part 1) : 1997	Safety of power transformers, power supply units and similar: Part 1 general requirements and tests
IS/IEC 61558 (Part 2/Sec 4) : 2009	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1100V – Part 2-4: Particular requirements and test for isolating transformers and power supply units incorporating isolating transformers
IEC 60947 (Part 6/Sec 2) : 2002+AMD1 : 2007	Low-voltage switchgear and control gear – Part 6-2: Multiple function equipment — Control and protective switching devices (or equipment) (CPS)

IS No./ Other Publication	*Title*
IEC 61180 : 2016	High-voltage test techniques for low-voltage equipment — Definitions, test and procedure requirements, test equipment
IEC 61316 : 1999	Industrial cable reels
IEC 61439 (Part 7) : 2018	Low-voltage switchgear and control gear assemblies — Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicles charging stations
IEC 62335 : 2008	Circuit breakers – Switched protective earth portable residual current devices for class I and battery powered vehicle applications
ISO 17409 : 2020	Electrically propelled road vehicles — Conductive power transfer — Safety requirements

3 TERMS AND DEFINITIONS

For the purpose of this standard, the following definitions in addition to those given in IS 17017 (Part 1) shall apply.

3.1 LEV AC charge point

Device that supplies alternating current to Electric Vehicle (EV). Equipment providing dedicated functions to supply electric energy from fixed electrical installation or supply network to Light Electric Vehicles for the purpose of charging.

3.2 Type test

Unless otherwise stated all tests indicated in this standard are type tests.

Unless otherwise stated, all tests required by this standard may be conducted on separate samples or on the same sample as per the mutual agreement between the user and the manufacturer.

Unless otherwise stated, each test is conducted once.

4 GENERAL REQUIREMENTS

LEV AC charge point shall ensure safe energy transfer to Electric Vehicle during normal operation. It shall perform its intended operation with minimum risk of danger to life and property.

Unless otherwise stated all tests indicated in this standard are type tests.

5 MODE OF CHARGING, CONNECTION AND SOCKET-OUTLET/PLUG REQUIREMENT

5.1 Charging Modes

The LEV AC Charge Point is intended to be used with Mode 1 charging. In this charging mode, a method for the connection of an EV to a standard socket-outlet of an AC supply network, using a cable and plug, both of which are not fitted with any supplementary pilot or auxiliary contacts is made. LEV AC Charge Point intended for Mode 1 charging shall provide a protective earthing conductor from the standard plug to the vehicle potable charger or vehicle connector. The rated and maximum values for voltage and current shall be as Table 1.

NOTE — Requirement of protective earthing conductor may be exempted for vehicles having on-board charger with double / reinforced insulations structure.

Table 1 Rated and maximum values for voltage and current

(*Clause* 5.1)

Charging outlet: Single Phase AC	Rated Voltage	240 V a.c.
	Maximum Current	16 A a.c.

5.2 LEV AC Charge Point Socket-Outlet

Industrial Socket-outlet as defined in the IS/IEC 60309(Part 1) shall be used as a charging outlet of LEV AC Charge Point.

5.3 LEV AC Charge Point Plug

Specific plug as defined in the IS/IEC 60309 (Part 1) shall be used as part of LEV AC Charge Point.

5.4 Connection of LEV AC Charge Point with Vehicle

The standard covers following types of connection:

a) Case A Connection of an EV to the supply network with a plug and cable permanently attached to the EV (*see* Fig. 1).

NOTE — The cable assembly is part of the electric vehicle.

b) Case B Connection of an EV to a supply network with a cable assembly detachable at both ends (*see* Fig. 2).

NOTE — The detachable cable assembly is not part of the electric vehicle or the LEV AC Charge Point.

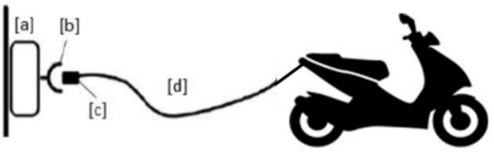


FIG. 1 CASE A CONNECTION

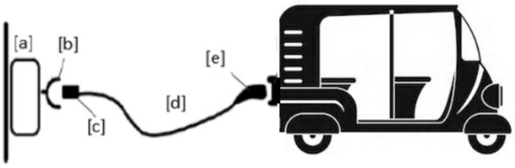


FIG. 2 CASE B CONNECTION

KEY

a EV AC Charge Point
b Socket outlet
c Plug
d Charging cable
e EV connector
f EV inlet

NOTE — Fig. 1 and Fig. 2 are indicative in nature. CASE A and CASE B connections can be used for 2 Wheelers, 3 Wheelers, Quadri-Cycle, etc.

6 USER INTERFACE REQUIREMENTS

6.1 Charging Operation

It shall be possible to perform charging start and stop operation through Mobile Phone Application or any other user interface.

6.2 Visual Indicators

Visual Indicators for fault, presence of input supply, presence of earth connection, charging under process, available back-up power, etc. shall be provided through LED indicators or other means with appropriate colour coding.

6.3 User Authentication

User Authentication shall be possible through Mobile Phone application and /or any other user interface like QR Code (*see* Annex A for State transition diagram, communication protocol and sequence).

6.4 Energy Measurement Information

LEV AC charge point shall provide energy consumption units through mobile application or any other user interface.

6.5 Emergency Stop

LEV AC charge point shall have provision of Electrical emergency stop device with mechanical latching function.

6.6 Power failure mode

LEV AC charge point shall have provision for low power pairing using push button type of a switch or any other mechanism to enable user to complete the charging session with actual energy consumed feedback in case of a.c. network input supply power failure.

7 ELECTRIC SUPPLY AC ENERGY MEASUREMENT

The LEV AC charge point shall be connected to AC supply network for conductive energy transfer function with in-built energy measurement feature. It shall have provision to measure and register active energy in watt-hours or in suitable multiples, thereof, by integrating active power with respect to time. Charging current and voltage shall be measured at LEV AC charge point for calculation of power delivered (kW) and total energy consumed (kWh).

LEV AC Charge Point shall transfer safe electrical energy to the Electric vehicle only after the authentication process. The charging start-stop shall be controlled with a dedicated contactor/ relay at the output stage of LEV AC Charge Point. User Authentication, start of charging command, energy measurement and end of charging session shall control the contactor/ relay ON-OFF operation.

7.1 Accuracy of Energy Measurement Requirement

LEV AC charge point shall perform electrical energy measurement in accordance with Class 1 accuracy as per 11 of IS 13779:2020. LEV AC Charge point shall store energy consumed in its memory to handle power failure situation with sampling rate of at least once in a minute.

Additionally, following test conditions shall be maintained:

a) LEV AC Charge point shall be earthed and shall be fitted with enclosures and accessories mounted during normal operation.
b) Before initialization of a test, the circuits shall be energised till thermally stable.
c) The tests shall be performed at $(23)^{+5}_{-5}$ °C.
d) The nominal supply voltage shall be 240 V a.c.
e) The nominal frequency shall be $(50)^{+0.5}_{-0.5}$ Hz

The percentage error in energy measurement when LEV AC Charge point carries single-phase load at current levels specified in Table 2 and unity power factor, shall not exceed ±1 percent.

Percentage error in energy measurement =

$$\frac{E2 - E1}{E1} \times 100$$

Where,

E1 = Master Energy meter measured value (kWh);

E2 = LEV AC Charge Point Energy Measured value (kWh) indicated on mobile application or any other user interface; and

Table 2 Accuracy of energy measurement observation

(*Clause* 7.1)

LEV AC Charge Point Supply Voltage at Socket-Outlet (V a.c.)	Load Current (A)	Test Duration in minutes
216	2.5	20
	5	20
	10	20
	15	20
240	2.5	20
	5	20
	10	20
	15	20
	15	60
264	2.5	20
	5	20
	10	20
	15	20

8 BILLING AND PAYMENT

A mobile application or other appropriate interface shall be defined for enabling billing and payments.

9 COMMUNICATION

LEV AC charge point shall have provision to communicate with Mobile Application/ other user interface with Bluetooth Low Energy (BLE) communication protocol compatible with version 4.0 and higher. Based on Bluetooth communication, using dedicated communication circuit, LEV AC charge point shall meet requirements of Generic Attribute Profile (*see* Annex A for Message classification, Packet allocation, Messages, State transition diagram, Communication protocol and sequence).

10 BATTERY BACK-UP FOR CONTROL CIRCUIT

In case of supply failure, LEV AC Charge Point shall have visual alarm indication and shall have backup power to support control circuit of LEV AC Charge point for at least 15 minutes. Power back-up shall enable EV owner and charge point operator with the help of push button type of a switch or any other mechanism to complete the charging session and retrieve information of actual energy consumed on mobile application/other user interface, in case of supply power failure.

11 DURABILITY TEST

LEV AC charge Point shall be operated in charging mode at 50% of the rated capacity for 5 minutes and then shall be switched off for 2 minutes. The cycle, consisting of charging period of 5 minutes and switched off period of 2 minutes, is repeated 300 times. The test shall be performed at $(23)_{-5}^{+5}$ °C.

During and after the test, LEV AC charge point shall be checked for permanent failure of operation, if any and shall continue to perform its normal operation as designated.

12 TESTS

12.1 Protection Against Electric Shock

12.1.1 *Degree of protection against access to hazardous-live-parts*

LEV AC charge point shall have an IP degree, according to IS/IEC 60529 : 2001, as follows:

a) Enclosure: at least IPXXC; and
b) Plug mated with socket-outlets: IPXXD

Compliance is checked by test in accordance with IS/IEC 60529 : 2001.

12.1.2 *Protective Earth Conductor*

The protective earth conductor shall be of sufficient rating in accordance with requirements of IEC TS 61439-7. LEV AC Charge Point intended for Mode 1 charging shall provide a protective earthing conductor from the standard plug to the vehicle potable charger or vehicle connector.

NOTE — Requirement of protective earthing conductor is exempted for vehicles having on- board charger with double / reinforced insulations structure.

Compliance is checked by inspection.

12.2 Earth Presence Detection

Provision for visual indication shall be provided for presence of earth connection at input of charge point.

Compliance is checked by inspection.

12.3 Relays

Relays used to switch the main current path shall comply with IS/IEC 61810-1 with the following minimum characteristics:

a) Fifty thousand cycles and
b) Contact category: CC 2.

12.4 Residual Current Protection

LEV AC charge point shall have suitable residual current detection device with rated residual operating current not exceeding over 30 mA and nominal operating time of 300 ms. After detecting residual current, LEV AC Charge point shall disconnect all live conductors at the output.

Compliance is checked by measurement.

12.5 Insulation Resistance

The insulation resistance measured with a 500 V dc voltage applied between all inputs/outputs connected (power source included) and the accessible parts shall be more than 1 MΩ. The test voltage shall be applied for 1 min. For this test, all extra low voltage (ELV) circuits shall be connected to the accessible parts during the test. The measurement of insulation resistance shall be carried out with the protective impedances disconnected.

12.6 AC Withstand Voltage test

The dielectric withstand voltage, at power frequency of 50 Hz, shall be applied for 1 min.

(U_n + 1 200 V) (r.m.s.) in common mode (all circuits in relation to the exposed conductive parts) and differential mode (between each electrically independent circuit and all other exposed conductive parts or circuits) as specified in 5.3.3.2 of IS 15382 (Part 1): 2014.

NOTE — U_n is the nominal line to neutral voltage of the neutral-earthed supply system.

12.7 Over Current and Short-Circuit Protection

LEV AC charge point shall have protection against over-current and short-circuit current. Such overcurrent protective devices shall comply with IS/IEC 60947-2, IEC 60947-6-2 or IS 12640 (Part 2) or with the relevant parts of IS/IEC 60898 series or IS 13703 series.

12.8 Ingress Protection

12.8.1 *Degrees of Protection Against Solid Foreign Objects and Water for the Enclosures*

Enclosures of the LEV AC Charge Point shall have an IP degree at least IP 54, according to IS/IEC 60529 : 2001.

Compliance is checked by test in accordance with IS/IEC 60529: 2001.

12.8.2 *Degrees of Protection Against Solid Foreign Objects and Water for Socket-Outlet and Plug*

The socket-outlet and plug of LEV AC charge Point shall fulfill the following requirements, according to IS/IEC 60529 : 2001:

a) Plug mated with LEV AC Charge Point socket-outlet: at least IP44;
b) LEV AC Charge Point socket-outlet when not mated: at least IP24.

Compliance is checked by test in accordance with IS/IEC 60529: 2001.

13 ENVIRONMENTAL REQUIREMENTS

13.1 Operating Temperature

The LEV AC Charge Point shall remain functional at $(23)^{+5}_{-5}$ °C and shall withstand the following tests:

13.1.1 *Minimum Temperature Functional Test*

The LEV AC Charge Point shall be pre-conditioned in accordance with IS 9000 (Part 2) : 1997 at -5 °C for (16 ± 1) h. While maintaining the mentioned temperature, the LEV AC charge point shall be subjected to charging session at rated capacity for 10 minutes. The device shall continue to perform its normal operation without any failure.

13.1.2 *Maximum Temperature Functional Test*

The LEV AC Charge Point shall be pre-conditioned in accordance with IS 9000 (Part 3/Sec 3) or IS 9000 (Part 3/Sec 5), as applicable, at 55°C for (16 ± 1) h. While maintaining the mentioned temperature, the LEV AC charge point shall be subjected to charging session at rated capacity for 10 minutes. The device shall continue to perform its normal operation without any failure.

13.1.3 *Damp Heat Functional Test*

The LEV AC charge Point shall be subjected to damp heat (cyclic) test at (40±3)°C and relative humidity of 95 percent for 6 cycles. The LEV AC charge point shall be subjected to charging session at rated capacity for 10 minutes.

Immediately after the conditioning, the device shall be subjected to Insulation Resistance test as per **12.5.**

14 ELECTROMAGNETIC COMPATIBILITY REQUIREMENTS

LEV AC charge Point shall be subjected to (applicable) tests as per Table 3:

15 MARKING AND INSTRUCTION

15.1 Installation Manual of LEV AC Charge Point

The installation manual along with wiring instructions of LEV AC charge point shall be supplied with each unit. The manual shall indicate installation requirements, the characteristics of protection devices used, explicitly, describing their type and rating. The information may be provided in a detailed electric diagram. The installation manual shall indicate ratings or any other information that denote special (severe or unusual) environmental conditions of use.

15.2 User Manual of LEV AC Charge Point

Information for user related to operation of LEV AC charge point shall be provided by the manufacturer in a user's manual.

15.3 Marking of LEV AC Charge Point

The manufacturer shall provide LEV AC charge point with one or more labels, marked in a durable manner and located at place(s) such that they are visible and legible when installed.

a) Manufacturer's name, or trade mark;
b) Type designation or identification number or any other means of identification, making it possible to obtain relevant information from the manufacturer;
c) Date of manufacture;
d) Type of current;
e) Number of phases;
f) Rated voltage (input and output if different);
g) Rated current (input and output if different);
h) Degree of protection;
i) Operating temperature; and
j) Country of manufacture.

Table 3 Electromagnetic compatibility requirements

(*Clause* 14)

Sr. No.	Test	Test Specifications	Performance Criteria	Test Method
Enclosure (In Waiting and Charging Mode)				
1	Electrostatic Discharge (ESD)	±4 kV – Contact Discharge (CD) ±8 kV – Air Discharge (AD)	B	IS 17017 (Part 21/Sec 2)
2	Radiated RF Fields			
2.1	Range 1	10 V/m, 80-1000 MHz, 80% AM (1 kHz)	A	IS 17017 (Part 21/Sec 2)
2.2	Range 2	3 V/m, 1.4-2 GHz, 80% AM (1 kHz)	A	
2.3	Range 3	3 V/m, 2-2.7 GHz, 80% AM (1 kHz)	A	
3	Voltage Dips and Interrupts	40% residual voltage for 10 cycles at 50 Hz	B	IS 17017 (Part 21/Sec 2)
		70% residual voltage for 25 cycles at 50 Hz	B	
		0% residual voltage for 1 cycle at 50 Hz	B	
		0% residual voltage for 250 cycles at 50 Hz	C	
4.	Radio frequency emissions	IS 17017 (Part 21/Sec 2)	Class A limits	IS 17017 (Part 21/Sec 2)
5.	Conducted RF fields	3V (RMS), 150KHz to 80 MHz, 80% AM (1 KHz)	A	IS 17017 (Part 21/Sec 2)

ANNEX A

(*Clauses* 4, 5, 6, 7, 8 *and* 9)

ENERGY TRANSFER PROCESS AND COMMUNICATION PROTOCOL

A.1 COMMUNICATION MEASURES

Communication between the LEV AC Charge Point and the mobile application is carried out through the Bluetooth communication.

A.2 MESSAGE CLASSIFICATION

A.2.1 Handshake stage

Handshake stage consists of time sync and diagnostic messages. After pairing with BLE, mobile App sends handshake messages to LEV AC charge Point and both will enter handshake stage. The messages of handshake stage shall be in accordance with those specified in Table A.2.1.

A.2.2 Initialization stage

After EV connected to the LEV AC charge Point, Mobile App initializes the charging operation by sending the initialization message to LEV AC Charge Point by pressing the start button. If initialized, LEV AC Charge Point communicates the next stage to Mobile App. The messages of initialization stage shall be in accordance with those specified in Table A.2.2.

A.2.3 Authorization stage

LEV AC Charge Point will intimate its next state to Mobile App during initialization state. After receiving the authorization state from LEV AC Charge Point, Mobile App creates the session Id and sends the authorization request to LEV AC Charge Point. During this stage, LEV AC Charge Point will stay in the same state until it gets ready for delivering power. On confirmation of “EVSE ready” status to Mobile App, LEV AC Charge Point communicates the next state to Mobile App and enters into “charging state”. If not, it will go to “End of Charging” state and Session is closed. The messages of authorization stage shall be in accordance with those specified in Table A.2.3.

A.2.4 Charging stage

After receiving the “charging state” from LEV AC Charge Point in authorization response, Mobile App enters charging state. During charging, LEV AC Charge Point will share the relevant charging parameters like voltage, current and state with Mobile App.

If disconnection of Bluetooth occurs due to any reason, the Mobile App will reconnect and inquire the LEV AC Charge Point “state” by sending the diagnostic message to LEV AC Charge Point, if it is in charging state, app will go directly to charging state. The messages during charging stage shall be in accordance with those specified in Table A.2.4.

A.2.5 End of charging stage

Charging can be stopped either from Mobile App or from LEV AC Charge Point. After receiving the stop request, LEV AC Charge Point will enter into “End of charging” stage and communicate the state to Mobile App. During this stage, LEV AC Charge Point will send the session info including start time, stop time, reason of stop, and meter value to the Mobile App. The LEV AC Charge Point will remain in the “End of charging” stage until it receives an “End of charging” message request from Mobile App or wait until 60 second before going idle.

Table A.1 Status of operator, LEV AC charge point and electric vehicle at various steps

(*Clause* A.1)

LEV AC Charge Point state	Charge point operator	LEV AC Charge Point	Electric Vehicle status
State A: Idle	Not Connected	Not Connected	Vehicle Not connected with charger.
State B: Initialization	Pairing with charge point Connected and Communicating	Pairing with Mobile App Connected and Communicating	Vehicle Not connected with charger.
State C: Authorization	Connected and Communicating	Connected and Communicating	Vehicle connected to the Charger.
State D: Charging	Connected and Communicating	Connected and Communicating	Vehicle connected to the Charger.
State E: End of Charging	Connected and Communicating	Connected and Communicating	Vehicle connected to the Charger.
State F: Power Failure (Push button-based power backup for Controller)	Connected and Communicating	Connected and Communicating	Vehicle Connected /Not connected with LEV AC Charge Point

Table A.2.1 Classification of messages during handshake stage

(*Clause* A.2.1)

Message Name	Flow	Packet Length	Message Timeout (sec)
Time sync	Mobile App – LEV AC Charge Point	5	5
	LEV AC Charge Point - Mobile App	-	
Diagnostic	Mobile App – LEV AC Charge Point	14	5
	LEV AC Charge Point- Mobile App	28	

Table A.2.2 Classification of messages during Initialization stage

(*Clause* A.2.2)

Message Name	Flow	Packet Length	Message Timeout (sec)
Initialization	Mobile App – LEV AC Charge Point	12	5
	LEV AC Charge Point- Mobile App	19	

Table A.2.3 Classification of messages during authorization stage

(*Clause* A.2.3)

Message Name	Flow	Packet Length	Message Timeout (sec)
Authorization	Mobile App - LEV AC Charge Point	18	5
	LEV AC Charge Point- Mobile App	18	

Table A.2.4 Classification of messages during charging stage

(*Clause* A.2.4)

Message Name	Flow	Packet Length	Message Timeout (sec)
Charging	Mobile App - LEV AC Charge Point	19	NA
	LEV AC Charge Point- Mobile App	20	

Table A.2.5 Classification of messages during end of charging stage

(*Clause* A.2.5)

Message Name	Flow	Packet Length	Message Timeout (sec)
End of Charging	Mobile App - LEV AC Charge Point	11	60
	LEV AC Charge Point- Mobile App	26	

The messages during end of charging stage shall be in accordance with those specified in Table A.2.5.

A.2.6 Registration and Configuration stage

During this stage, a new charge point operator id can be registered in the LEV AC Charge Point. Only registered charge point operator id will get response from LEV AC Charge Point. There is also provision for defining certain threshold levels like minimum current level to detect connection of Electric vehicle, Minimum and maximum voltages of grid, etc.

The messages during this stage shall be in accordance with those specified in Table A.2.6.

A.2.7 Power Failure stage

During power failure, the charge point operator will press the push button on LEV AC Charge Point making the controller “ON”. After pairing, Mobile App shall send the diagnostic message to get the relevant state from the LEV AC Charge Point. If LEV AC Charge Point is in “End of charging” state, Mobile App will send the “end of charging” message and terminate the session.

A.2.8 Session Info stage

During session info stage, if authorized, Mobile App requests the session history from the LEV AC Charge Point, which in turn will provide the previous session details, saved in the LEV AC Charge Point memory.

A.2.9 Packet Format

The communication packets shall comply with format specified in Table A.2.7.

Table A.2.6 Classification of Messages During Registration and Configuration Stage

(*Clause* A.2.6)

Message Name	Flow	Packet Length	Message Timeout (sec)
Charge Point Operator registration	Mobile App - LEV AC Charge Point	5	5
	LEV AC Charge Point- Mobile App	1	
Threshold configuration	Mobile App - LEV AC Charge Point	14	5
	LEV AC Charge Point- Mobile App	1	

Table A.2.7 Packet allocation

(*Clause* A.2.9)

Section	Parameter	No of Bytes
Header	$	1
Header	Date – Time(ddmmyy)	6
Header	Packet Type 1-Initialization 2-Authorization 3 -Charging 4-End of charging 5-Diagnostic 6-Session log 7–Time 8-Operator Registration 9-Threshold Configuration 10-EV Owner Registration 11-Schedule Charging 12–Operator Id Request	1
Header	Data Length	1
Data	Data	-
Footer	Checksum (Summation of Data)	2
Footer	#	1

A.3 LEV AC CHARGE POINT BLUETOOTH COMMUNICATION PROTOCOL

Table A.3.1 Messages from LEV AC charge point

(*Clause* A.3)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Initialization	19	1	7 – 0	LEV Protocol Version	-	1	0	-	-	1	Version of protocol	5s
		2	7 – 0							0		
		3	7 – 0	Charger State - Idle - 0 Initialization - 1 Authorization - 2 Charging - 3 End of charging - 4 Error - 5	-	1	0	0	7	1	Present state of charger 1=Initialization or 2=Authorization[if initialized]	
		4	7 – 0	LEV Charge Point Id-Identification Number	-	1	0	-	-	47	16-byte unique identification for LEV Charge Point	
		5	7 – 0							48		
		6	7 – 0							49		
		7	7 – 0							50		
		8	7 – 0							51		
		9	7 – 0							52		
		10	7 – 0							53		
		11	7 – 0							54		
		12	7 – 0							55		
		13	7 – 0							56		
		14	7 – 0							57		
		15	7 – 0							58		
		16	7 – 0							59		
		17	7 – 0							60		
		18	7 – 0							61		
		19	7 – 0							62		

Table A.3.1 (*Continued*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Authorization	18	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	5s
		2	7 – 0							32		
		3	7 – 0							33		
		4	7 – 0							34		
		5	7 – 0							1		
		6	7 – 0							77		
		7	7 – 0							5		
		8	7 – 0							98		
		9	7 – 0							5A		
		10	7 – 0							53		
		11	7 – 0	Session Start OK (accepted or not)	-	1	0	0	1	1	0=Not accepted, 1=Accepted	
		12	7 – 0	Payment OK(ACK)	-	1	0	1	3	1	1=Cash,2=Contract,3=Prepaid	
		13	7 – 0	LEV Charge Point Max Voltage Limit	V	100	0	0	300	61	Max voltage of charger 250*100=25000=61A8x	
		14	7 – 0							A8		
		15	7 – 0	LEV Charge Point Max Current Limit	A	100	0	0	16	07	Max current of charger 20*100=2000=07D0x	
		16	7 – 0							D0		
		17	7 – 0	LEV Charge Point Ready	-	1	0	0	1	1	2=Not ready, 1=Ready	
		18	7 – 0	Charger State - Idle - 0 Initialization - 1 Authorization - 2 Charging - 3 End of charging - 4 Error - 5	-	1	0	0	7	2	2=Authorization or 3=Charging [if Authorized] 4=End of Charging [if not Authorized]	

Table A.3.1 (*Continued*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Charging	20	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	-
		2	7 – 0							32		
		3	7 – 0							33		
		4	7 – 0							34		
		5	7 – 0							1		
		6	7 – 0							77		
		7	7 – 0							5		
		8	7 – 0							98		
		9	7 – 0							5A		
		10	7 – 0							53		
		11	7 – 0	Start/Stop of charging Ack	-	1	0	0	1	1	0=stop, 1=start	
		12	7 – 0	Meter value (Kwh)	Kwh	1000	0	0	65,536□	15	Meter reading from energy meter 5.5*1000=5500 = 157Cx	
		13	7 – 0							7C		
		14	7 – 0	Meter voltage (Output)	V	100	0	0	300	59	Voltage from energy meter 230*100=23000=59D9x	
		15	7 – 0							D9		
		16	7 – 0	Meter current (Output)	A	100	0	0	16	03	Current from energy meter 10*100=1000=03E8x	
		17	7 – 0							E8		
		18	0 – 0	Invalid Operator ID	-	1	0	0	65,536□	0	Error Code	
			1 – 1	Power Failure								
			2 – 2	Invalid Session ID								
			3 – 3	Checksum Mismatch								
			4 – 4	Less than Min Current								
		19	0 – 0	Mains low								
			1 – 1	Mains high								
			2 – 2	Output current high								
			3 – 3	Earth disconnect								
			4 – 4	Earth leakage								
			5 – 5	Neutral-Earth detect								
			6 – 6	Emergency								
			7 – 7	Temperature Failure								
		20	7 – 0	Charger State - Idle - 0 Initialization - 1 Authorization - 2 Charging - 3 End of charging - 4 Error - 5	-	1	0	0	7	3	3=Charging or 4=End of charging [if charging stopped]	

Table A.3.1 (*Continued*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
End of Charging	26	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	60s
		2	7 – 0							32		
		3	7 – 0							33		
		4	7 – 0							34		
		5	7 – 0							1		
		6	7 – 0							77		
		7	7 – 0							5		
		8	7 – 0							98		
		9	7 – 0							5A		
		10	7 – 0							53		
		11	7 – 0	Date-Time of start	dd	1	0	-	-	12	Charging start date and time 18/03/21,11:01:52	
		12	7 – 0		mm					3		
		13	7 – 0		yy					15		
		14	7 – 0		HH					B		
		15	7 – 0		MM					1		
		16	7 – 0		SS					34		
		17	7 – 0	Date-Time stop	dd	1	0	-	-	12	Charging stop date and time 18/03/21,11:01:52	
		18	7 – 0		mm					3		
		19	7 – 0		yy					15		
		20	7 – 0		HH					B		
		21	7 – 0		MM					1		
		22	7 – 0		SS					34		
		23	7 – 0	Charger State - Idle - 0 Initialization - 1 Authorization - 2 Charging - 3 End of charging - 4 Error - 5	-	1	0	0	7	4	4=End of charging 0=Idle(after 60 sec from End of Charging)	
		24	7 – 0	Reason Of Stop 0=Normal, 1=suspended by charger, 2=suspended by user, 3=LEV CHARGE POINT Not Ready , 4=Timeout(only for Initialization and Authorization), 5=Power Failure, 6=Mains low 7=Mains high 8=Output current high 9=earth leakage 10=earth disconnect 11= Neutral-Earth detect 12=emergency 13=Temperature Failure	-	1	0	0	7	0	0=Normal	
		25	7 – 0	Meter value (Kwh)	Kwh	1000	0	0	65,536□	15	Meter reading from energy meter 5.5*1000=5500 = 157Cx	
		26	7 – 0							7C		

Table A.3.1 (*Continued*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Session Log Response	26	1	7 – 0	Log ID	-	1	0	1	10	1	10 Max Messages: Log ID =Max Log ID to1. Session log number stored in charger memory	-
		2	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	
		3	7 – 0							32		
		4	7 – 0							33		
		5	7 – 0							34		
		6	7 – 0							1		
		7	7 – 0							77		
		8	7 – 0							5		
		9	7 – 0							98		
		10	7 – 0							5A		
		11	7 – 0							53		
		12	7 – 0	Date-Time of start	dd	1	0	-	-	12	Charging start date and time 18/03/21,11:01:52	
		13	7 – 0		mm					3		
		14	7 – 0		yy					15		
		15	7 – 0		HH					B		
		16	7 – 0		MM					1		
		17	7 – 0		SS					34		
		18	7 – 0	Date-Time stop	dd	1	0	-	-	12	Charging stop date and time 18/03/21,11:01:52	
		19	7 – 0		mm					3		
		20	7 – 0		yy					15		
		21	7 – 0		HH					B		
		22	7 – 0		MM					1		
		23	7 – 0		SS					34		
		24	7 – 0	Total Meter Unit consumed	Kwh	1000	0	0	65,536□	15	Meter reading from energy meter 5.5*1000=5500 = 157Cx	
		25	7 – 0							7C		
		26	7 – 0	Reason Of Stop 0=Normal, 1=suspended by charger, 2=suspended by user, 3=LEV CHARGE POINT Not Ready , 4=Timeout(only for Initialization and Authorization), 5=Power Failure, 6=Mains low 7=Mains high 8=Output current high 9=earth leakage 10=earth disconnect 11= Neutral-Earth detect 12=emergency 13=Temperature Failure	-	1	0	0	7	0	0=Normal	

Table A.3.1 (*Continued*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Diagnostic / Power Failure	28	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session. If received Operator ID is registered with charger, send response else no response.	-
		2	7 – 0							32		
		3	7 – 0							33		
		4	7 – 0							34		
		5	7 – 0							1		
		6	7 – 0							77		
		7	7 – 0							5		
		8	7 – 0							98		
		9	7 – 0							5A		
		10	7 – 0							53		
		11	0 – 0	Invalid Operator ID	-	1	0	0	65,536□	0	Defined Error codes	
			1 – 1	Power Failure								
			2 – 2	Invalid Session ID								
			3 – 3	Checksum Mismatch								
			4 – 4	Less than Min Current								
		12	0 – 0	Mains low								
			1 – 1	Mains high								
			2 – 2	Output current high								
			3 – 3	Earth leakage								
			4 – 4	Earth disconnect								
			5 – 5	Neutral-Earth detect								
			6 – 6	Emergency								
			7 – 7	Temperature Failure								
		13	7 – 0	Charger State - Idle - 0 Initialization - 1 Authorization - 2 Charging - 3 End of charging - 4 Error - 5	-	1	0	0	7	4	Current state of charger	
		14	7 – 0	Date-Time of start	dd	1	0	-	-	12	Charging start date and time 18/03/21,11:01:52	
		15	7 – 0		mm					3		
		16	7 – 0		yy					15		
		17	7 – 0		HH					B		
		18	7 – 0		MM					1		
		19	7 – 0		SS					34		
		20	7 – 0	Date-Time stop (power stop)	dd	1	0	-	-	12	Charging stop date and time 18/03/21,11:01:52	
		21	7 – 0		mm					3		
		22	7 – 0		yy					15		
		23	7 – 0		HH					B		
		24	7 – 0		MM					1		
		25	7 – 0		SS					34		
		26	7 – 0	Session active		1	0	0	1	1	0=No active, 1=Active	
		27	7 – 0	Meter value (Kwh)	Kwh	1000	0	0	65,536□	15	Meter reading from energy meter 5.5*1000=5500 = 157Cx	
		28	7 – 0							7C		

Table A.3.1 (*Concluded*)

Message	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (Hex)	Description	Timeout
Time Sync	0											
Operator Registration	1	1	7 – 0	Ack	-	1	0	1	2	0	1=Registered Ok/Already existing, 0=Not Registered	-
Threshold Configuration	1	1	7 – 0	Ack	-	1	0	1	2	0	1=Ok, 2=Not Ok	-
EV Owner Registration	1	1	7 – 0	Ack	-	1	0	1	2	0	1=Ok, 2=Not Ok	-
Schedule charger Response	1	1	7 – 0	Ack	-	1	0	1	2	0	1=Ok, 2=Not Ok	
Operator Id Response	5	1	7 – 0	Operator ID number	-	1	0	1	10	1	10 Max Messages: Operator ID number=Max Operator ID number to 1. Operator ID number stored in charger memory	
		2	7 – 0	Operator ID	-	1	0	-	-	31	Operator ID stored in charger memory	
		3	7 – 0							32		
		4	7 – 0							33		
		5	7 – 0							5A		

Table A.3.2 Messages to LEV AC Charge Point

(*Clause* A.3)

Message	Period	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (HEX)	Description	Time out
Initialization	1s	12	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Date-Time	dd	1	0	-	-	12	Charging start date and time 18/03/21,11:01:52	
			6	7 – 0		mm					3		
			7	7 – 0		yy					15		
			8	7 – 0		HH					B		
			9	7 – 0		MM					1		
			10	7 – 0		SS					34		
			11	7 – 0	LEV Protocol Version	-	1	0	0	65,536□	1	Protocol Version	
			12	7 – 0							0		

Table A.3.2 (*Continued*)

Message	**Period**	**DLC**	**Byte**	**Bit**	**Name**	**Unit**	**Gain**	**Offset**	**Min**	**Max**	**Sample Data (HEX)**	**Description**	**Time out**
Authorization	1s	18	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	5s
			2	7 – 0							32		
			3	7 – 0							33		
			4	7 – 0							34		
			5	7 – 0							1		
			6	7 – 0							77		
			7	7 – 0							5		
			8	7 – 0							98		
			9	7 – 0							5A		
			10	7 – 0							53		
			11	7 – 0	Vehicle Type 2W/3W/ Quadricycle/4W	-	1	0	1	2	1	1=2W,2=3W ,3=quadricycle,4=4W	
			12	7 – 0	Payment Type CASH/Prepaid/ Contract	-	1	0	1	3	1	1=Cash,2=Contract,3=Prepaid	
			13	7 – 0	Total meter unit required	Kwh	1000	0	0	65,536□	15	Meter Units required= 0 then the charger should be stopped from App. If Meter Units required> 0 Stop after Meter Units reach to required units. 5.5*1000=5500 = 157Cx	
			14	7 – 0							7C		
			15	7 – 0	EV owner - Identification Number	-	1	0	-	-	45	4-byte EV Owner ID *for example,* (ASCII-EV03)	
			16	7 – 0							56		
			17	7 – 0							30		
			18	7 – 0							33		
Charging	10s or more	19	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	60s
			2	7 – 0							32		
			3	7 – 0							33		
			4	7 – 0							34		
			5	7 – 0							1		
			6	7 – 0							77		
			7	7 – 0							5		
			8	7 – 0							98		
			9	7 – 0							5A		
			10	7 – 0							53		
			11	7 – 0	Start/Stop of charging Request	-	1	0	1	2	1	1=Start 2=Stop	
			12	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	
			13	7 – 0							30		
			14	7 – 0							30		
			15	7 – 0							33		
			16	7 – 0	EV owner - Identification Number	-	1	0	-	-	45	4-byte EV Owner ID (ASCII-EV03)	
			17	7 – 0							56		
			18	7 – 0							30		
			19	7 – 0							33		

Table A.3.2 (*Continued*)

Message	**Period**	**DLC**	**Byte**	**Bit**	**Name**	**Unit**	**Gain**	**Offset**	**Min**	**Max**	**Sample Data (HEX)**	**Description**	**Time out**
End of Charging	-	11	1	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	60s
			2	7 – 0							32		
			3	7 – 0							33		
			4	7 – 0							34		
			5	7 – 0							1		
			6	7 – 0							77		
			7	7 – 0							5		
			8	7 – 0							98		
			9	7 – 0							5A		
			10	7 – 0							53		
			11	7 – 0	Start/Stop of charging Request	-	1	0	1	2	2	2=stop, 1=start	
Session Log Request	-	4	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		
Diagnostic /Power Failure	1s	14	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003) If Operator ID is registered with charger, Mobile App will receive active Session ID in response	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Session ID	-	1	0	-	-	31	Unique session ID generated by Mobile App for each session.	
			6	7 – 0							32		
			7	7 – 0							33		
			8	7 – 0							34		
			9	7 – 0							1		
			10	7 – 0							77		
			11	7 – 0							5		
			12	7 – 0							98		
			13	7 – 0							5A		
			14	7 – 0							53		
Time Sync	-	5	1	7 – 0	Get/Set	-	1	0	0	1	0	0=Get, 1=Set	5s
			2	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	
			3	7 – 0							30		
			4	7 – 0							30		
			5	7 – 0							33		
Operator Registration	-	5	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Enter /Delete	-	1	0	1	2	0	1=Enter, 2=Delete	

Table A.3.2 (*Concluded*)

Message	Period	DLC	Byte	Bit	Name	Unit	Gain	Offset	Min	Max	Sample Data (HEX)	Description	Time out
Threshold Configuration	-	14	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Max voltage	V	100	0	0	300	59	Max available voltage 230*100=23000=59D9x	
			6	7 – 0							D9		
			7	7 – 0	Min voltage	V	100	0	0	300	52	Min available voltage 210*100=21000=5208x	
			8	7 – 0							08		
			9	7 – 0	Max current	A	100	0	0	16	06	Max available current 16*100=1600=0640x	
			10	7 – 0							40		
			11	7 – 0	Min current	A	100	0	0	16	00	Min available current 1*100=100=0064x	
			12	7 – 0							64		
			13	7 – 0	NE Voltage threshold required	-	1	0	0	1	0	0=Enable, 1=Disable	
			14	7 – 0	Earth Detect Threshold required	-	1	0	0	1	0	0=Enable, 1=Disable	
EV Owner Registration	-	5	1	7 – 0	EV Owner Identification Number	-	1	0	-	-	45	4-byte EV Owner ID (ASCII-EV03)	5s
			2	7 – 0							56		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Enter /Delete	-	1	0	1	2	0	1=Enter, 2=Delete	
Schedule charge Request	-	16	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-EV03)	5s
			2	7 – 0							56		
			3	7 – 0							30		
			4	7 – 0							33		
			5	7 – 0	Start Date-Time	dd	1	0	-	-	12	Charging start date and time 18/03/21,11:01:52	
			6	7 – 0		mm					3		
			7	7 – 0		yy					15		
			8	7 – 0		HH					B		
			9	7 – 0		MM					1		
			10	7 – 0		SS					34		
			11	7 – 0	Stop Date-Time	dd	1	0	-	-	12	Charging sop date and time 18/03/21,13:08:21	
			12	7 – 0		mm					3		
			13	7 – 0		yy					15		
			14	7 – 0		HH					D		
			15	7 – 0		MM					8		
			16	7 – 0		SS					15		
Operator Id Request	-	4	1	7 – 0	OID - Operator Identification Number	-	1	0	-	-	45	4-byte Operator ID (ASCII-E003)	5s
			2	7 – 0							30		
			3	7 – 0							30		
			4	7 – 0							33		

A.4 GENERIC ATTRIBUTE (GATT) PROFILE IN LEV AC CHARGE POINT

GATT defines the way with which two Bluetooth Low Energy (BLE) devices transfer data using concepts called Services and Characteristics. The custom GATT profile deployed in LEV AC Charge Point to exchange the data over a BLE connection.

UUID (Universally Unique Identifier) is a unique number used to identify services, characteristics, and descriptors, also known as attributes.

LEV AC Charge Point shall have its specific 128-bit custom service UUID used for charging purpose.

The EV Charging service UUID shall have two 128-bit characteristics UUID's, one for transmission and another for reception. The LEV AC Charge Point shall read the message from the reception UUID (read Property) and shall respond back by writing the reply on transmission UUID (write Property).

Service UUID (xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx)

Transmission UUID (xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx)-Write

Reception UUID (xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx)-Read

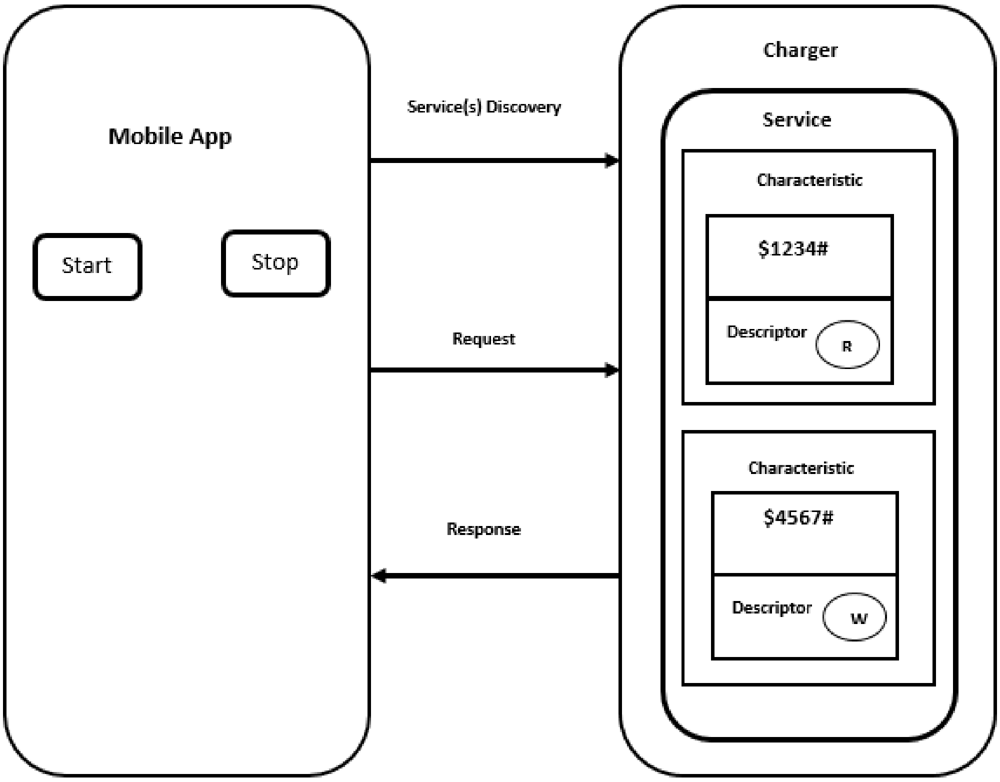


FIG. A.4.1 GATT PROFILE DEPLOYED IN THE CHARGER

The mobile application, using BLE protocol shall pair with the LEV AC charge Point using a passkey. mobile application shall be able to control and monitor the device operation by writing the command in the reception UUID of the LEV AC charge point.

The mobile application shall fetch the response from the LEV AC Charge Point such as status and details from the transmission UUID.

The Mobile Application shall be able to read the complete data from the transmission UUID from start of frame to End of Frame. The messages shared between Mobile App and the LEV AC charge Point using the communication protocol shall be as per format detailed in Table A.2.7.

A.5 ENERGY TRANSFER CONTROL PROCESS

A.5.1 State transition diagram and sequence diagram

The energy transfer process shall comply with the state transition diagram, which gives the energy transfer control sequence under normal operating conditions. Fig. A.5.1 gives a flow chart for general operating conditions for LEV AC Charge Point under normal operating conditions.

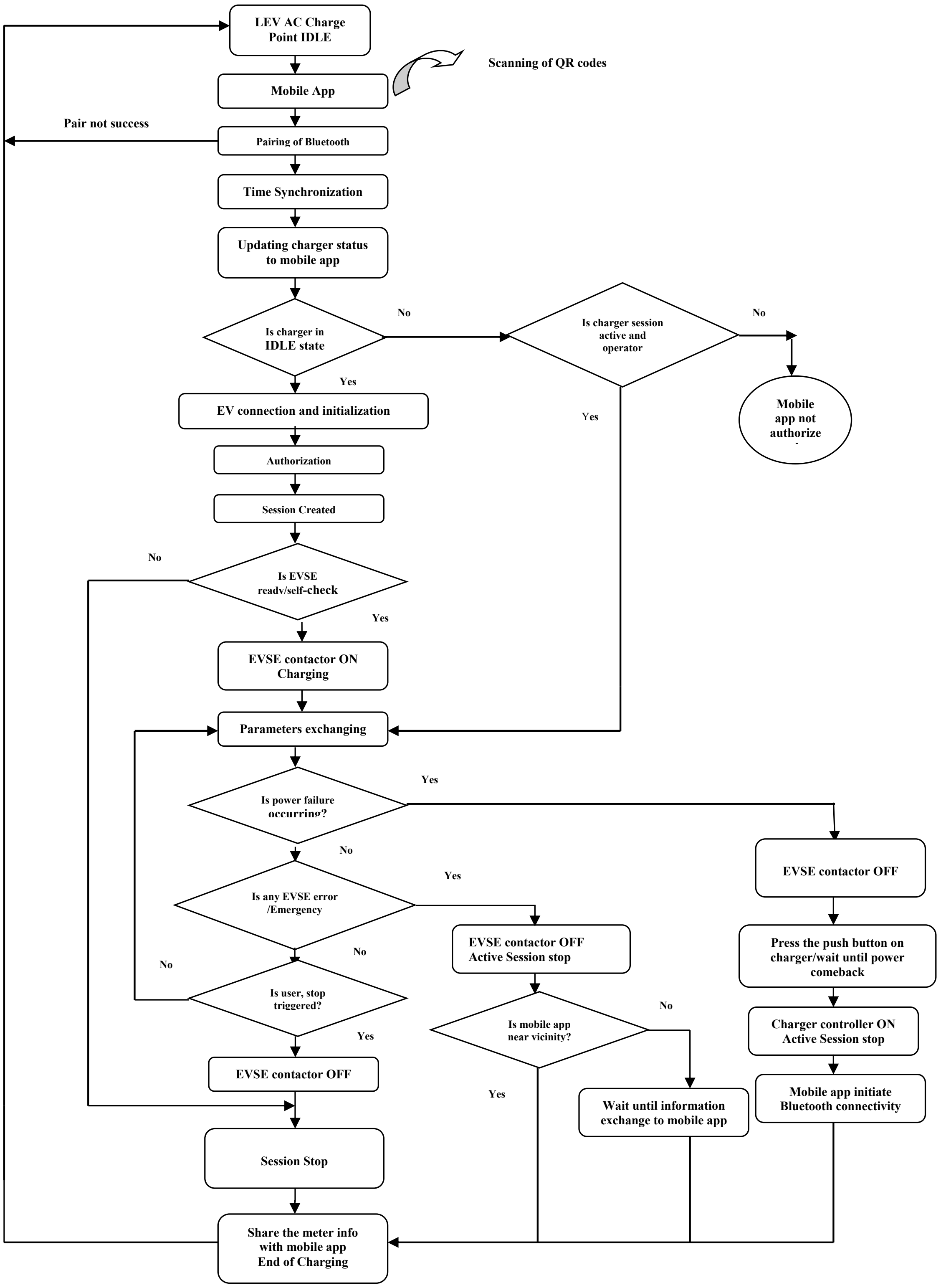

LEV AC Charge Point IDLE
Scanning of QR codes
Mobile App
Pair not success
Pairing of Bluetooth
Time Synchronization
Updating charger status to mobile app
Is charger in IDLE state
No
Is charger session active and operator
No
Mobile app not authorize
Yes
Yes
EV connection and initialization
Authorization
Session Created
No
Is EVSE ready/self-check
Yes
EVSE contactor ON Charging
Parameters exchanging
Yes
Is power failure occurring?
EVSE contactor OFF
No
Yes
Is any EVSE error /Emergency
EVSE contactor OFF Active Session stop
Press the push button on charger/wait until power comeback
No
No
Is user, stop triggered?
No
Is mobile app near vicinity?
Charger controller ON Active Session stop
Yes
EVSE contactor OFF
Yes
Wait until information exchange to mobile app
Mobile app initiate Bluetooth connectivity
Session Stop
Share the meter info with mobile app End of Charging

Fig. A.5.1 Flow Chart for General Operating Conditions for Lev AC Charge Point

ANNEX B

(*Clause* 5)

(*normative*)

LEV AC CHARGE POINT WITH SINGLE PHASE SUPPLY INPUT AND SINGLE PHASE SOCKET OUTLET

B.1 GENERAL

This annexure describes the LEV AC charge point circuit diagrams for charging mode and case connections using a single-phase socket outlet.

The single-phase output shall support LEV AC charge points rated at 240 V a.c., 16Amp through a 3-pin industrial socket-outlet. The characteristics of the single-phase outlet setup are as follows:

a) It shall ensure adequate safety. Compliance is checked by **12.**

b) It shall have an in-built energy measurement mechanism.

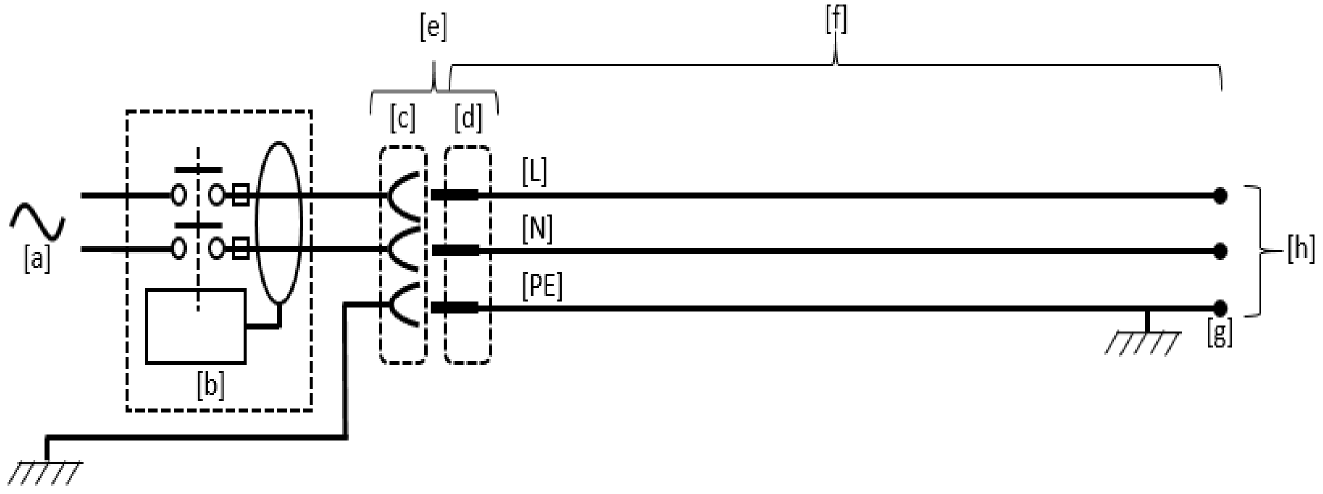
c) To facilitate safe charging process, communication protocols shall comply with the requirements specified in **9**.

d) It shall have provision of a battery back-up unit to log energy consumption data during power failure events.

e) At any point of time, it shall support charging of only one electric vehicle.

f) The output socket of LEV AC charge point shall be 3 pin socket-outlet as per IS/IEC 60309 series.

B.2 CIRCUIT DIAGRAM FOR MODE-1 CASE-A USING A SINGLE-PHASE SOCKET- OUTLET

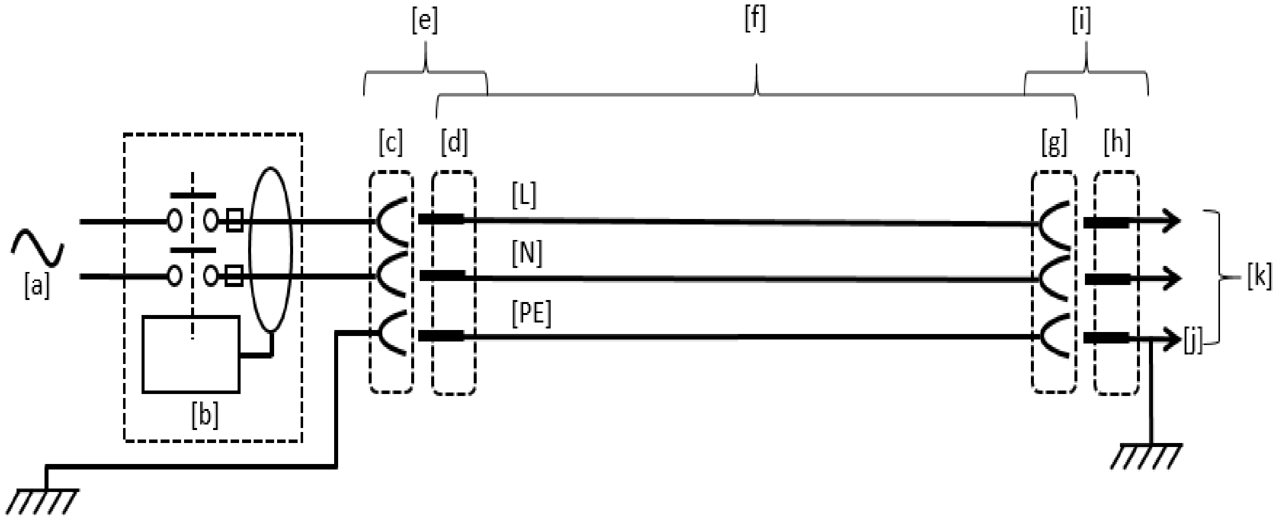


Key

a	Supply network	e	LEV AC Charge Point Coupler
b	LEV AC Charge Point	f	Vehicle Cable assembly
c	LEV AC Charge point socket-outlet	g	Vehicle chassis connection
d	EV plug	h	On-board charger connection

FIG. B.2.1 CIRCUIT DIAGRAM FOR MODE-1 CASE-A USING A SINGLE-PHASE SOCKET-OUTLET

B.3. CIRCUIT DIAGRAM FOR MODE-1 CASE-B USING A SINGLE-PHASE SOCKET- OUTLET



Key			
a	Supply network	g	EV connector
b	LEV AC Charge Point	h	EV inlet
c	Charge point socket-outlet	i	EV coupler
d	EV Plug	j	Vehicle chassis connection
e	Charge point coupler	k	On-board charger connection
f*	Cable assembly		

* It can also be off-board d.c. charger (portable charger) for Light Electric Vehicle.

FIG. B.3.1 CIRCUIT DIAGRAM FOR MODE-1 CASE-B USING A SINGLE-PHASE SOCKET-OUTLET

ANNEX C

(*Clause* 8)

(*Informative*)

EXAMPLES OF POSSIBLE BUSINESS MODELS

This standard defines unique protocol on Bluetooth (BLE) to address all the aspects of communication between LEV AC charge point and mobile application. The protocol is designed to enable “mobile application” to exercise all the capabilities of LEV AC charge point for conductive charging of light electric vehicles. With the help of this basic communication, different “Mobile Applications” can be designed to cater with possible business models and corresponding back-end communication. This informative Annex provides details of few possible configurations.

C.1 BUSINESS MODEL FOR OPERATIONS THROUGH CHARGE POINT OPERATOR (CPO)

This is a typical grocery shop / Petrol pump business model. LEV AC Charge Point shall be operated by registered charge point operator (CPO). Example of general flow of the process is as explained below:

a) Charge Point Operator Registration (One time activity):

   Charge Point Operator shall downloasd the mobile application and register with back end server by providing the required information. Registration information may include profile of the charge point operator (name, mobile number), GPS location, etc. Operator shall validate the pairing mode by providing a unique key corresponding to the LEV AC charge point. The unique key shall be hard-coded into the equipment. While paring, the LEV AC Charge Point shall validate the unique key Id. Mobile Mobile application shall search through Bluetooth for nearby LEV AC Charge Points and select the suitable LEV AC charge point allocated to the charge point operator; pair the EV and save the paring mode in mobile application.

b) EV Owner Registration (One time activity):

   EV owner shall download the mobile application and register with back end server by providing theinformation. Registration information may include profile of the EV owner (name, mobile number), EV category, model, registration number, etc.

c) While bringing the EV for charging, the owner shall generate a QR Code on the mobile application. For authorization of charging session, the owner’s generated QR code shall be scanned by charge point operator’s mobile application.

d) After plugging-in the connector of EV with the LEV AC Charge Point, the Charge Point Operator shall start the charger from his Mobile App. The charger shall send information to both EV owner’s mobile application as well as charge point

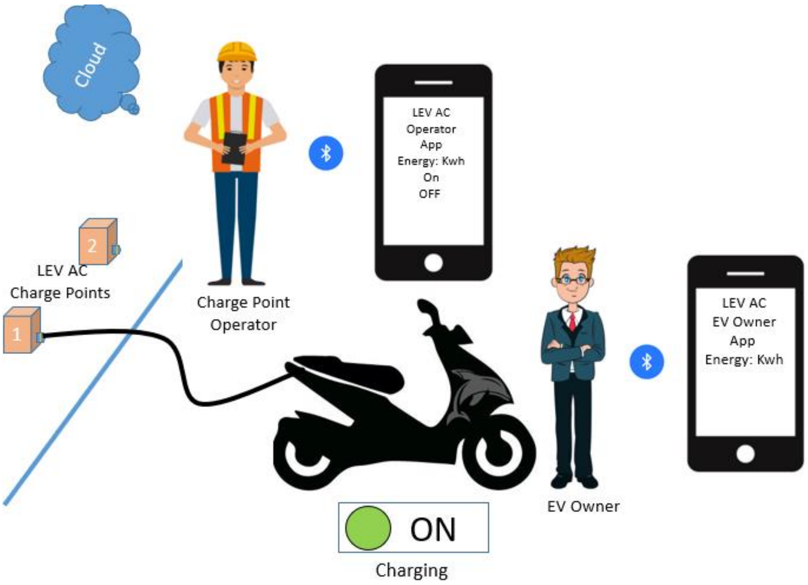

Cloud
LEV AC Operator App Energy: Kwh On OFF
2
LEV AC Charge Points
1
Charge Point Operator
LEV AC EV Owner App Energy: Kwh
EV Owner
ON
Charging

FIG. C 1.1 TYPICAL GROCERY SHOP BUSINESS MODEL operator's mobile application. The EV owner shall receive limited information pertaining to energy metering.

e) In case the operator /EV owner leaves the charging station during charging, there will be break in BLE comminciation. However LEV AC charge point still contineus performing with desginated function. The operator / EB owner shall be able to get the current status of the charger by initiating a query command to the charger once he comes back in BLE range.

f) If connector (Plug or EV Connector) gets disconnected, it shall automatically terminate the charging session. The detection shall be ensured with of minumum threshold current settings with timeout duration. New sessions may be initiated only after proper authentication.

g) To know the status of energy consumed during the charging process, EV owner shall be able to pair the mobile application at any point of time. However, operation of LEV AC charge point shall be in control of charge point operator.

h) Charge point operator shall be able to initiate "end of charge" session through mobile application. On end of charge session, LEV AC charge point shall report the energy consumed and billing amount to charge point operator and EV owner.

i) LEV AC charge point shall have minumum of 15 minutes of power battery back up to enable charge point operator to complete the charging session and retrieve information of actual energy consumed,in case of power failure.

j) LEV AC charge point shall be able to store all the details of previous 8 charging sessions. Mobile application shall store information of previous 100 charging sessions. Charge Point Operator shall connect the mobile application to cloud platform for storage of all the sessions information. Cloud connectivity shall be provided for reporting and analysis purpose.

A: EV Not Connected
A1.1 – Scan QR code LEV AC charge Point
A1.2 – Scan QR code EV Owner Mobile App
A-B1: Connection of EV
B1: Mobile App connection
B1.1 – Pair the charge point operator Mobile application with Charger based on the QR code Info.
B1.2 – Pair the EV Owner Mobile application with Charger based on the QR code Info.
B1-A: Pair not success
B1-B2: Protocol initialization
B2: Time synchronization
B2.1 – Exchange time frame between Mobile App and charger
B2-B3: Protocol initialization
B3: Updating present charger status to Mobile App
B3-B4: LEV AC Charge Point status Idle
B3-D: LEC AC Charge Point in charging state(reconnection)
B4: EV connection and Initialization
B4.1 – Information exchange between LEV AC Charge Point and mobile app
B4.2 – Vehicle connector inserted into vehicle inlet
B4 – C: Information received at charge point
C: Authorization
C1.1: Session Id created by LEV AC Charge Point.
C1.2: LEV AC Charge Point self-check and indication of “EVSE Ready”
C1.3: Intimate Mobile App the LEV AC Charge Point Ready
C-E: LEV AC Charge Point not ready
C-D: LEV AC Charge Point ready
D: Charging
D1.1: LEV AC Charge Point contactor On
D1.2: Limited Charging Parameters (charging status) shared with Mobile App (EV Owner)
D1.3: All Charging Parameters shared with Mobile App(operator (CPO)
D1.4: Charge Point Operator can reconnect with the charger and retrievethe current charging status.
D-E: Shutdown event (EV Owner stop or Charging finished).
D-F: Power failure Occurs
E: End of Charging
E1.1: EVSE contactor Off
E1.2: Meter units details shared with Mobile App (operator (CPO)) if charging done
E1.3: Mobile App (Operator (CPO)) shares the billing inform to EV Owner
E1.4: EV Owner App, BHIM and Payment done
E1.5: Disconnection of EV
E-A: Idle state
E-F: Power failure Occurs
F: Power Failure:
F1.1: LEV AC Charge Point Contactor Off
F1.2: Charge Point Operator will press the Push button
F1.3: LEV AC Charge Point Controller share the billing information to the Mobile App operator (CPO) using power backup.
F1.4: Mobile App operator (CPO) share the bill info to EVowner.

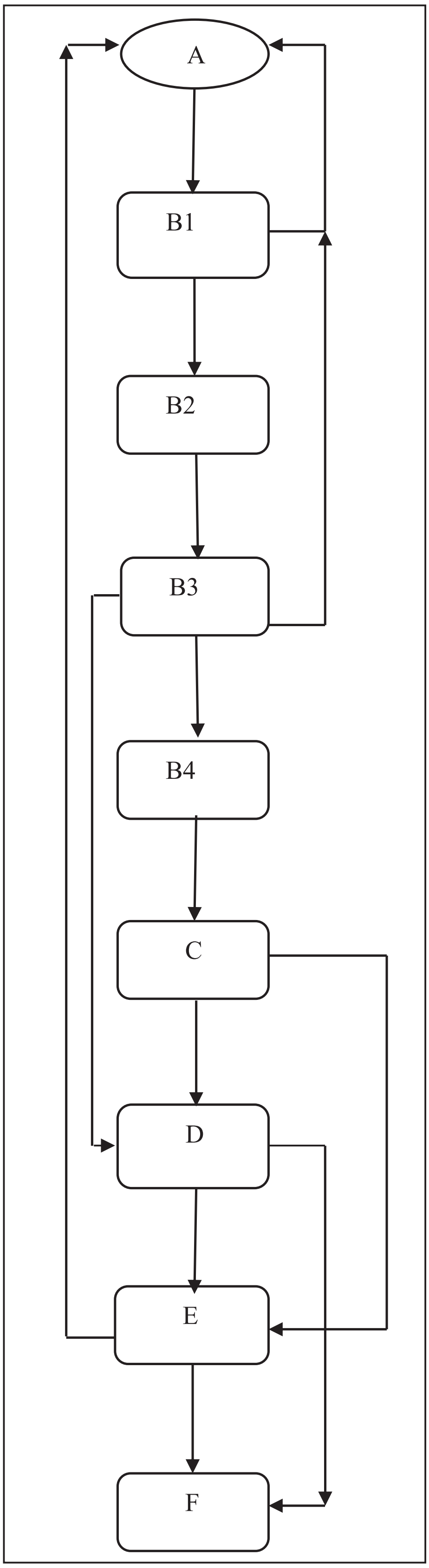


Fig. C.1.2 Graphical Representation of the Energy Transfer Control Under Normal Operating Conditions Specific to Grocery Shop / Petrol Pump Business Model

C.2 BUSINESS MODEL FOR OPERATIONS DIRECTLY WITH EV OWNER.

This is a typical parking lot business model. LEV AC charge point shall be directly operated by registered EV owner. Example of general flow of the process is as explained below.

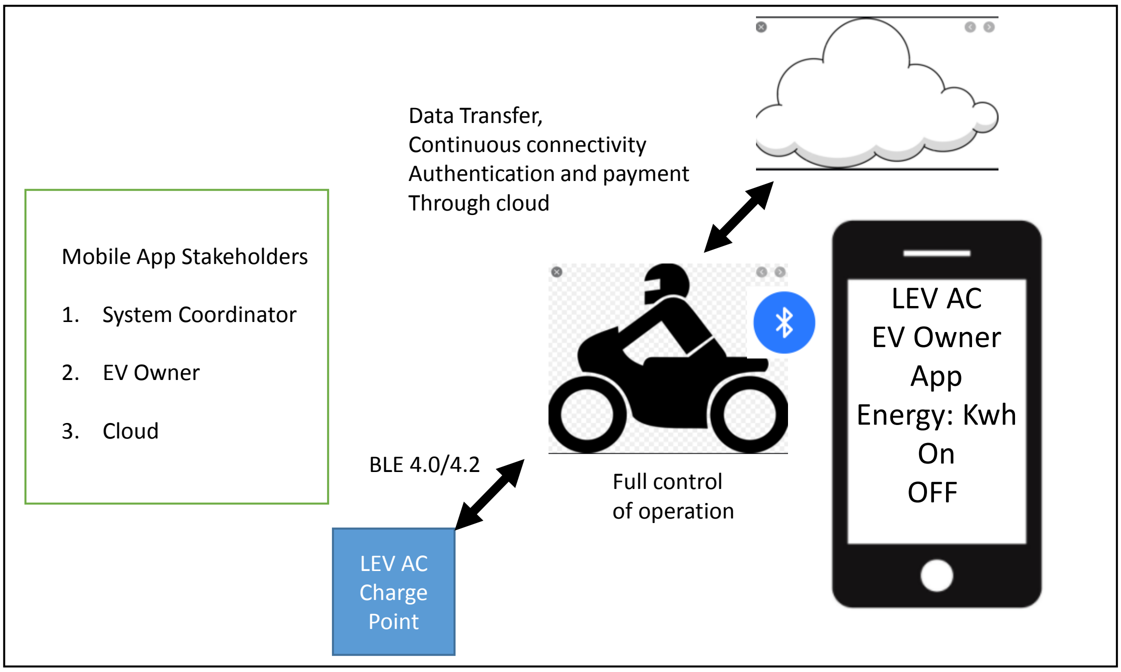


FIG. C.2.1 TYPICAL RESIDENTIAL PARKING LOT BUSINESS MODEL

ANNEX D

LIST OF ABBREVIATIONS

AC	Alternating Current
BHIM	Bharat Interface for Money
BLE	Bluetooth Low Energy
CC	Contact Category
CPS	Control and Protective Switching devices
CPO	Charge Point Operator
DER	Distributed Energy Resources
DLC	Data Length Code
ELV	Extra Low Voltage
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
HMI	Human Machine Interface
IP	Ingress Protection
KW	kilo-watt
KWH	kilo-watt hour
LEV	Light Electric Vehicles
MCB	Miniature Circuit Breaker
PEL	combined protective earthing conductor and Line conductor
PEM	combined protective earthing conductor and mid-point conductor
PEN	combined protective earthing conductor and neutral conductor
PHEV	Plug In Hybrid Electric Vehicle
QR Code	Quick Response Code
RCCB	Residual Current Operated Circuit Breaker
RCD	Residual Current Device
REESS	Rechargeable energy storage system
RMS	Root Mean Square
SMS	Short Message Service
UPI	Unified Payment Interface
LEV	Light Electric Vehicle
Mobile App	Mobile Application

ANNEX E

(*Foreword*)

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Amendments Issued Since Publication

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